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The Mystery of Worms in Rain.

THE mysterious appearance of earth worms at certain times and places mentioned by Mr. Charles B. Palmer in *Science*, No. 570, is easily explained, it seems to me, by close observation of the worms under favorable conditions. Several of his queries are answered more or less directly by the following quotation from the manuscript of a little book on animal studies which I prepared several years ago, but which was never published:

"The time was in May during very rainy weather. The best place for observation was a portion of the lawn over which earth had recently been spread several inches deep. The bare ground of a garden which had not been disturbed since last year was almost as good.

"On going out in the early evening, a constant slight snapping sound could be heard proceeding from the ground. Moving carefully, in order not to jar the ground and frighten the worms, a spot was selected for observation.

"Looking closely, a dozen or more worms could be seen on each square foot of ground; some extended nearly full length on the surface, others protruding but an inch or so of the head. All were constantly moving the head about as if searching for something. Next morning several holes were found with blades of grass drawn partly in.

"A two-gallon jar was nearly filled with moist earth and placed in the house, where a lamp could be used for observation at night. Some worms were put in and a few blades of grass placed on the earth. All the worms kept below the surface during the day, but in the evening were always active at the surface.

"One evening after a rain a worm was noticed crawling on the second step of the porch. A few minutes later it was crawling along the *under* side of the projection of the third step and was soon over on the top investigating things to its satisfaction."

Under ordinary conditions the worms remain concealed in their burrows during the day, but they habitually come to the surface at night, as is well known. That they immediately seek to penetrate the earth on being dug up necessarily follows from their extreme wariness, which prompts them to retreat at the least sign of danger. When they come to the surface "to be pelted by the rain" I have no doubt that they are accepting the lesser of two evils by escaping a deluge underground. Having seen a worm crawl comfortably along the under side of a painted board, I see no reason why it should not reach the roof and go down the conductor to the cistern. Nor does its climbing powers seem remarkable when we consider the moist, clinging body, and the peculiar organs of locomotion.

This does not disprove the "rain down" theory, but only shows that, so far as earth worms are concerned, the phenomenon may have a more reasonable explanation. As to the sudden appearance of frogs after a shower, it is stated that this is a common occurrence in certain tropical countries, where the excessive heat and dryness drive them to seek shelter under leaves and earth till the cooling rain calls them out. In the month of August I have found live water beetles of the family *Hydrophyllidae* buried deeply in swamp earth, where they had retreated probably two months before when the last drop of water evaporated. The remarkable degree of adjustment to the environment, which permits most animals of the lower orders to remain for a long time in a state of suspended activity, will doubtless explain most of these mysterious apparitions when all the conditions are known. C. D. McLOUTH.

Muskegon, Mich., Jan. 20, 1894.

BOOK REVIEWS.

An Elementary Treatise on Theoretical Mechanics. By ALEX. ZIWET. New York and London, Macmillan and Co. 1893, two vols.; 8vo, pp. 181, 175.

THE two volumes here mentioned contain, the one the outlines of kinematics, the other those of statics. A third volume, to include the treatment of dynamics, is promised later. The author, Professor Ziwet, of the University of Michigan, has sought to secure a good text-book in pure mechanics, especially well adapted to the student in the higher class of American colleges. The European method of study of the mathematics is stated to be the presentation of the science of mechanics before taking up the higher mathematics and its review after a later study of the calculus and other advanced mathematical studies. In this country it is more usual to study mechanics only after the course of higher mathematics has been taken. The work is intended as an introduction to the science of theoretical mechanics; but is also expected to prove useful to engineering students preparing for work in applied mechanics and related subjects. Theories are illustrated by special problems, and sets of exercises are introduced to be worked out by the student. Good care has been taken to make the references full and amply numerous to facilitate later or collateral reading.

The treatise on kinematics is one of the best which has been yet presented and gives an excellent presentation of this comparatively recent, and, as yet, incompletely developed, science. It is based on Reuleaux and other German writers mainly, and is one of the most systematic and continuous discussions of the subject which has appeared in English. The subject of statics is well planned, well written and well carried out in detail. The whole work is evidently the product of one familiar with his subject and capable of giving his work the form which experience has shown him to be desirable. The book-making is excellent. The paper and press-work are admirable, and the two volumes are most creditable to both author and publisher.

A System of Easy Lettering. By J. H. CROMWELL. New York, Spon and Chamberlain, 1893, 27 p., 12mo, \$0.50.

THIS little book is full of excellent illustrations of the most simple, as well as the most complicated and most graceful, forms of draughtsman's letters, arranged and proportioned especially for his use. The scheme is simply as stated in the preface: "We have but to divide any surface we may wish to letter into squares (or parallelograms, as the case may be) in pencil lines; form the required letters, in ink or paint, and, according to the style chosen, erase the pencil lines, and the lettering is complete." The selections are good, the work is excellent and the make-up of the book all that could be desired.

Steam Machinery and the Marine Engine. By J. LANGMAID and H. GAISFORD, of the Royal Navy. London and New York, Macmillan & Co. 1893, 8vo, xv., 267 p. New edition, revised and enlarged.

THESE elementary lessons in steam marine machinery are prepared for the use of the naval cadets of the British navy, and are introductory to more formal and mathematical studies. They include a purely descriptive account of the details of machinery, prefaced by chapters on the forms and uses of drawing instruments, statements of the properties of the materials of engineering construction, and of the various forms of joints and fastenings, such as riveting and bolting. The book is very exceptionally well-illustrated, and all the important engravings are made to a stated scale, so that it is easy to ascertain